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LASER DESIGNATOR

by

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LASER DESIGNATOR

Lin Chao Ching

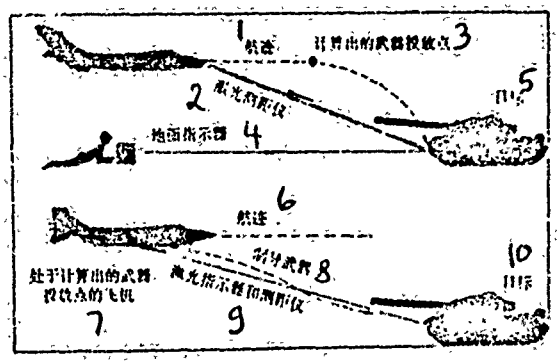
A soldier was trapped in a muddy bunker by an enemy tank several hundred meters away. He used the view-finder on a litter green box supported by a tripod to aim at the tank and then pressed a button. Suddenly, an airplane appeared on the horizon. It flew at low altitude directly toward the tank and gave it a fatal blow. The mission was accomplished with high precision and speed which minimized the threats of any attack by ground fire and cleared the obstacle for the ground troops, to allow them to proceed to their destinations. The above had been imagined by many people as a representative picture of close air support in actual combat. Today, this has already materialized due to the invention of the laser designator.

Laser technology has been applied very successfully to the launching of various weapons to date. Laser techniques which are far less susceptible to external interference have already been used to measure the distance of targets replacing the conventional radar systems.

Laser designators have been installed as range finders for the weapons launching systems on the British "Hawk" and the American "Bobcat" aircraft.

In this case a laser is used to identify the target and estimate the distance of the target. The target must first be identified and then its range will be determined. Therefore, two lasers are generally used. In the above example, the soldier carried a laser which sent its beam to the target (see Figure 1). A detector installed in the nose cone of the airplane received the signal and thus helped the pilot to identify the target and prevented him from harming a wrong target (e.g. his own tank). In most cases, the pilot never got to see the tanks. The narrow beam emitted by the laser not only reduces the chances of enemy

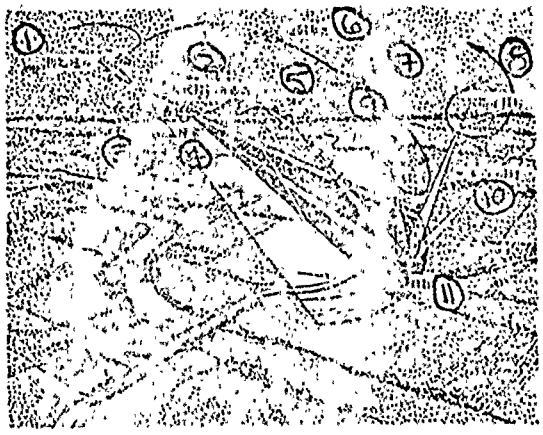
detection but also ensures the precise designation of targets within a 10 kilometer range.



1. Airplane flight path
2. Laser range finder
3. Calculated weapon launch point
4. Ground laser designator
5. Target
6. Airplane flight path
7. Airplane at the calculated weapon launch point
8. Guided weapon
9. Laser designater and range finder
10. Target

Figure 1. Ground Laser Designater Used by Soldier to Identify Targets

The soldier may even be able to locate the most crucial structual point of a bridge. In some cases, the designator is installed on board attack aircrafts or on fighter escorting unarmed airplanes which are equipped with electronic equipment and other modern weapons. (See Figure 2).



1. Starting position
2. Locate target and follow
3. Adjust position
4. Search
5. Dodge
6. Back to Base
7. Exit
8. Target locator
9. Launch weapon
10. Ground locator
11. Target

Figure 2. Laser Designator installed in an airplane to locate targets

It is mandatory to obtain precise distance and altitude information in order to successfully drop a bomb onto a small target at a calculated position when the plane is flying at ultrasonic speed at low altitude. The distance obtained using a radar is susceptible to large errors due to the relatively wide radar beam

reflected by a large area on the ground. On the contrary, the narrow laser beam is capable of providing the precise information needed to determine the target distance. The laser designator installed on board an airplane is capable of determining the range of a target in a 10 km radius within 1 meter.

The laser locator designator is not only technologically more superior but also more economical. The use of high precision laser designators greatly reduces the number of weapons systems and airplanes needed to destroy the targets. The more heavily guarded the targets are, the more advantageous it is to use this laser technique.

However, this laser technique can not totally replace other available weapons launching methods. For example, the identification of targets from the air is not always possible. The operation of a laser designator at night is also rather limited. This is especially true on a cloudy day which greatly reduces the intensity of a laser beam with distance. In these cases, the identification of targets becomes more difficult. The development of laser locator designator has already been successfully combined with conventional weapons systems such as free falling bamb, and delayed shells. The Americans specifically designed several laser designators for the "Hawks" and "Bobcats". During the Vietnam War, laser guided bombs were used. The aircraft, equipped with detectors were able to guide bombs and missiles with laser beam tracers with satisfactory precision (see Figures 3, 4, and 5). This techinque was proven to be especially powerful in destroying bridges in the Vietnam War.

The British install the laser designator inside the airplane, while the Americans use a removeable device, if the airplane is not efficiently utilized, the British system becomes economically impractical strictly based on capital cost considerations. With increasing complexity the more sophisticated laser designator system should be installed on board.

The potential applications of laser systems in aviation are very extensive. The more attractive feature is holographic photography. This is because any portion of a hologram, regardless of its size, can be used to reproduce the image of the original object. The smaller the area of the hologram, the lower the resolution becomes. It is due to this unique feature that holographic pictures are widely used. At this moment, research is underway in England to produce a holographic laser helmet designator which is capable of producing holograms. Another approach is to use a holographic vision system on a flight simulator.

It is also possible to use small semiconductor laser to build a gyroscope which would replace the inertia balancing gyroscope used in conventional guidance systems.

Lasers can also be used to determine visibility in fog, the change in wind speed and air velocity. Furthermore, it has been demonstrated that the irradiation of guided missiles in flight by by laser beams could incapacitate the missiles so that they became harmless.

1. Escape
2. Trajectory
3. Quided missile
4. Radio remote controlled spy plane
5. Lazer beam
6. Target
7. Radio Wave
8. Unmanned commend vehicle
9. Several miles
10. Attack plane

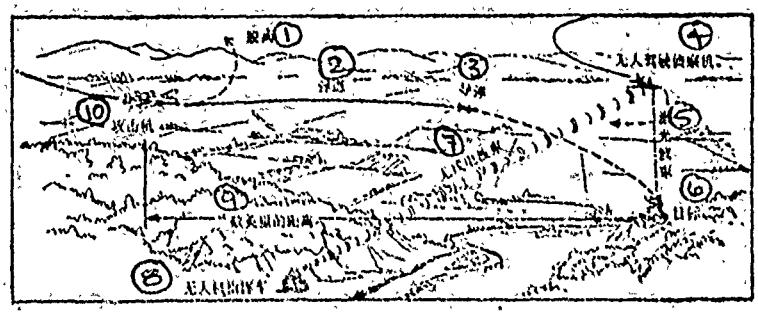


Figure 3. The unmanned airplane carries the laser designator to locate enemy tanks while the attack plane launches laser guided missile to destroy the target.

1. 155mm self-propelled cannon
2. 19 Kilometers
3. Unmanned spy plan
4. Laser designator
5. Enemy tanks
6. Radio wave
7. Unmanned commend vehicle
8. Mobile guided Missiles

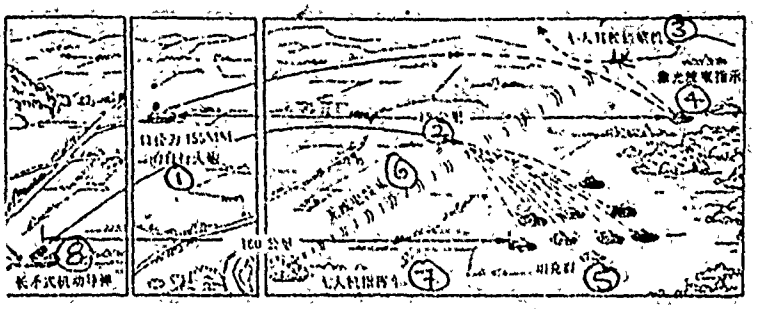


Figure 4. In response to enemy tanks, short range artillery shells are well as long range ground mobile guided missiles are launched, the latter in the form of a multi-war head missile.

1. Armed helicopter
2. 5 kilometers
3. Laser designator
4. Enemy tanks
5. 3 kilometers
6. Soldier
7. guided missile

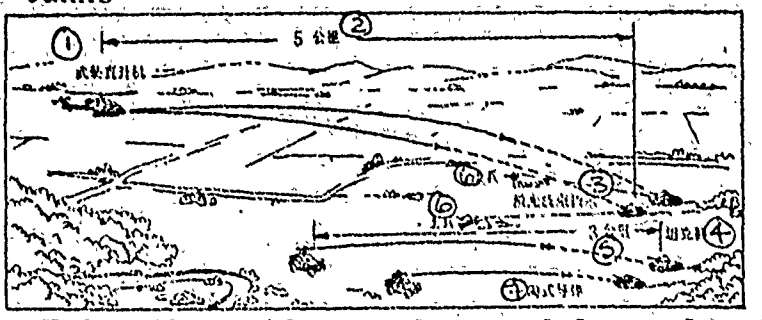


Figure 5 Under the guidance of ground laser locator designator operated by soldiers, the anti-tank helicopter and light jeep based laser guided missiles are launched.